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**Heat fixing unit - has endless belt with non-sticky outer surface  
stretched between fixed heating element and rotating roller**

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Abstract (Basic): JP 6075489 A

An endless metallic belt having a non-sticky outer surface, is stretched between a fixed heating element and a rotary driving roller to be rotated, and an image supporting member having an unfixed toner image is passed between a pressure roller rotating while closely kept into contact with the fixed heating element from the outside of the endless metallic belt and the endless metallic belt, for thermally melting and fixing the unfixed toner image.

The outer surface portion of the endless metallic belt is composed of iron-nickel alloy including 35 - 45 wt % of nickel. The inner surface portion of the belt is composed of nickel. The thickness of the outer surface portion is thicker than that of the inner surface portion.

USE/ADVANTAGE - By using the iron-nickel alloy of remarkably low linear expansion coefficient, wrinkling of the belt is completely prevented. The fixing unit is compact and simple.

Dwg.1/6

Title Terms: HEAT; FIX; UNIT; ENDLESS; BELT; NON; STICKY; OUTER; SURFACE;  
STRETCH; FIX; HEAT; ELEMENT; ROTATING; ROLL

Derwent Class: G08; M27; P84; S06

International Patent Class (Main): G03G-015/20

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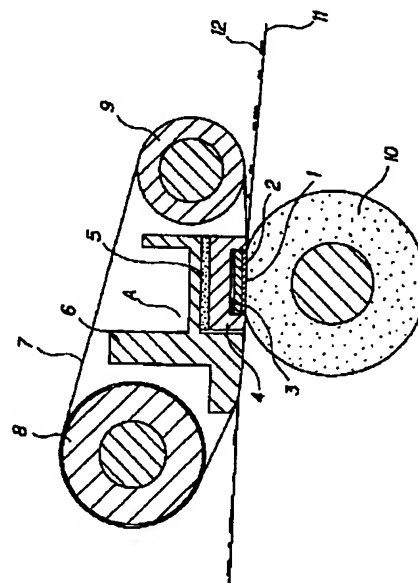
(54) 【発明の名称】 熱定着装置ならびにエンドレスメタルベルトの製造法

(57) 【要約】

【目的】 しわの発生原因を根本的に取り除くことができる熱定着装置を提供する。

【構成】 エンドレスメタルベルト7が35～45%の範囲のニッケルを含む鉄-ニッケル合金からなる。

【図1】



## 【特許請求の範囲】

【請求項1】 外側表面が非粘着性表面加工されているエンドレス金属ベルトを固定発熱体と回転駆動ローラ間に掛け渡して回転させると共に、該エンドレス金属ベルトの外側から固定発熱体に圧接して回転する加圧ローラとこのエンドレス金属ベルトとの間に未定着トナー像を持つ像支持体を通して該未定着トナー像を熱溶融定着させる熱定着装置において、前記エンドレス金属ベルトの外側表層部が35～45重量%のニッケルを含む鉄-ニッケル合金からなることを特徴とする熱定着装置。

【請求項2】 請求項1記載において、前記エンドレス金属ベルトの外側表層部が鉄-ニッケル合金からなり、エンドレス金属ベルトの内側表層部がニッケルからなり、前記外側表層部の厚さが前記内側表層部の厚さよりも厚いことを特徴とする熱定着装置。

【請求項3】 請求項2記載において、前記エンドレス金属ベルトのトータル厚みが10～50 $\mu\text{m}$ で、前記内側表層部の厚みが1～5 $\mu\text{m}$ であることを特徴とする熱定着装置。

【請求項4】 母型の外表面に形成された前記エンドレス金属ベルトを、その外周近傍に設置した電磁誘導コイルによつてエンドレス金属ベルトのみを急速加熱して熱膨張させて、該母型からエンドレス金属ベルトを離型させることを特徴とするエンドレス金属ベルトの製造法。

【請求項5】 母型の外表面に形成されたエンドレス金属ベルトを該母型に支持された状態で所定の表面処理を行い、その後前記エンドレス金属ベルトの外周近傍に設置した電磁誘導コイルによつてエンドレス金属ベルトのみを急速加熱して熱膨張させて、該母型からエンドレス金属ベルトを離型させることを特徴とするエンドレス金属ベルトの製造法。

【請求項6】 請求項4または5記載において、前記エンドレス金属ベルトの線膨張係数が前記母型の線膨張係数以下であることを特徴とするエンドレス金属ベルトの製造法。

【請求項7】 請求項4または5記載において、前記エンドレス金属ベルトと電磁誘導コイルとの間に生じる磁気的反発力を利用して、エンドレス金属ベルトを母型から抜くようにしたことを特徴とするエンドレス金属ベルトの製造法。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は電子写真等の画像形成装置の熱定着装置ならびにエンドレス金属ベルトの製造法に関するものである。

## 【0002】

【従来の技術】 電子写真記録装置に不可欠な熱定着器には熱板式、圧力式、ヒートローラ式等、幾つかの方式が

実用化されているが、ここ10年～20年間の主流はヒートローラ式である。しかしこの方式にも欠点があり、稼動開始までの時間が長くて消費電力も大きく、これらが電子写真装置全体の性能に悪い影響を及ぼしているのが現状である。

【0003】 これらを抜本的に改善する方式が古くから提案(USP3811828号明細書)されてはいたが、耐熱性と剛性に優れた薄いエンドレスフィルムを製造することが難しかった。

【0004】 特開平1-187582号には、非粘着性被膜でコートされたポリイミドフィルムと発熱体を組み合わせた定着器が開示されている。この熱定着器は、その昇温時間を極めて短時間とし、事実上のクイックスタートを実現させると共に、消費電力を半減に近い大幅削減することにも成功している。しかしこの方式にも欠点があり、エンドレスポリイミドフィルムに被覆されている非粘着性被膜の接着寿命が短く、定着器自体の構造も複雑でコスト高になることである。

【0005】 本発明者らは、この方式の優れた特徴を全て生かしつつ、これら定着器の抱える問題点を抜本的に解決できる方式を発明し、特許出願した(特開平4-166966号、特願平2-339079号、特願平3-49392号、特願平4-145868号、「熱定着装置」)。

【0006】 その構造的な第1の特徴は、エンドレスポリイミドフィルムに代わり、エンドレス金属ベルトを採用し、これによつて非粘着性被膜の接着寿命を問題のない実用寿命までに延ばすことに成功した。第2の特徴は、厚膜抵抗体ヒータに代わりPTCヒータを採用、これによつて温度センサと温度制御用電源を不要化した。第3の特徴は、熱定着後の記録紙が離型する温度を、トナーのガラス転移点よりは高く、軟化点よりは低い温度範囲に制御することによつてオフセットのないドライ定着が実現できたことである。また、平坦な熱定着面は今まで不可能であつた封筒などへの記録定着を可能とし、PTCヒータの自己温度制御は異型紙の混合連続定着にもオフセットを発生させない安定な加熱定着を実現させている。以上の説明から分かるように、方式的な簡素化は構造上の簡素化と部品点数の削減をもたらし、コスト的にも優位なものとなつている。ただこの実用化上、唯一とも言える障害は、エンドレス金属ベルトの「しわ」の発生であつた。これは最も容易に得られるエンドレス金属ベルトとして電鍍法によるNiベルトを採用したが、0～200℃の温度範囲でのNiベルトの平均線膨張係数は $14 \times 10^{-6} / ^\circ\text{C}$ と大きく、局部加熱による温度勾配が大きい場合にこの「しわ」が発生するのである。そしてこの「しわ」の発生防止法として温度勾配を緩和する方法(特願平03-279634号「熱定着装置」)とか、定着後の記録紙がエンドレス金属ベルトから離型する温度をトナーの軟化点よりは低く、し

かし出来るだけこれに近づけて結果的には温度勾配を小さくする改善発明(特願平04-145868号、「熱定着装置」)によつてこの問題を解決していた。

【0007】

【発明が解決しようとする課題】 前述したように、エンドレスNiメタルベルトを用いた熱定着装置には局部加熱による「しわ」が発生し易く、これを防止するためにはベルトの温度勾配を小さくすることが不可欠である。このため、ベルトの加熱距離と冷却距離が10~20mm程度必要となり、しかも固定発熱体を中凸のクラウン形状にするなどの対策が不可欠であつた。これらは本方式の熱定着装置を複雑、大型化し、製造コストの点からも改善が望まれていた。

【0008】 本発明の第1の目的は、エンドレスメタルベルトのしわ発生を抑制することにある。また第2の目的は、エンドレスメタルベルトの製造工程において母型から容易に離型する方法を提供することにある。さらに第3の目的は、エンドレスメタルベルトを母型から容易に離型すると共に、エンドレスメタルベルトの表面処理時のハンドリングを容易にすることにある。

【0009】

【課題を解決するための手段】 上記第1の目的は、外側表面が非粘着性表面加工されているエンドレスメタルベルトを固定発熱体と回転駆動ローラ間に掛け渡して回転させると共に、該エンドレスメタルベルトの外側から固定発熱体に圧接して回転する加圧ローラとこのエンドレスメタルベルトとの間に未定着トナー像を持つ像支持体を通過させて該未定着トナー像を熱溶融定着させる熱定着装置において、前記エンドレスメタルベルトの外側表面層部が35~45重量%のニッケルを含む鉄-ニッケル合金からなる第1の手段により達成される。

【0010】 また上記第2の目的は、母型の外表面に形成された前記エンドレスメタルベルトを、その外周近傍に設置した電磁誘導コイルによつてエンドレスメタルベルトのみを急速加熱して熱膨張させて、該母型からエンドレスメタルベルトを離型させる第2の手段により達成される。

【0011】 さらに上記第3の目的は、母型の外表面に形成されたエンドレスメタルベルトを該母型に支持された状態で所定の表面処理を行い、その後前記エンドレスメタルベルトの外周近傍に設置した電磁誘導コイルによつてエンドレスメタルベルトのみを急速加熱して熱膨張させて、該母型からエンドレスメタルベルトを離型させる第3の手段により達成される。

【0012】

【作用】 前述したように、エンドレスNiメタルベルトに発生しやすい「しわ」の原因はその大きな線膨張係数にある。これを上記のような組成範囲のFe-Ni合金にかえると、この0~200℃の温度範囲の平均線膨張係数はNi金属の1/2~1/5となり、実用的にも

「しわ」の発生防止対策が不要となる。

【0013】

【実施例】 本発明の実施例を図面と共に説明する。

【0014】 図1は本実施例の熱定着装置の断面図である。

【0015】 熱定着装置は、摺動均熱板1、PTCヒータ素子2、通電電極3、耐熱性ホルダ4、断熱材5、冷却支持材6からなる一体構造型加熱冷却デバイスA、外側表面を非粘着加工したエンドレスメタルベルト7、エンドレスメタルベルト7を一体構造型加熱冷却デバイスAに密着させながら回転駆動させる駆動ローラ8と従動ローラ9、および一体構造型加熱冷却デバイスAの摺動均熱板1に数Kgの力で押し付けられながら従動回転する加圧ローラ10からなっている。

【0016】 記録紙11が図1に示すようにエンドレスメタルベルト7と加圧ローラ10間で挟送される間に、記録紙11上の未定着トナー12はエンドレスメタルベルト7を介して加熱溶融し、ベルト7が冷却支持材6によつて冷却されると共にトナー12も冷却され、トナー温度がその軟化点より低くなつてから記録紙11がベルト7から剥離するよう冷却支持材6の先端部が小さな曲率になるよう加工されている。

【0017】 エンドレスメタルベルト7はステンレス製円型母型上に電鍍法によつてFe-Ni合金薄膜(約20μm厚)を形成し、これを母型から剥離して引き抜き、この外側表面にPTFE(ポリテトラフルオロエチレン)を5μmの厚さで被覆して作製した。この場合のNi組成は35%~45%の範囲(残りはFe)とした。図2にFe-Ni合金の線膨張係数を示すが、本発明の定着器として使用される時のエンドレスメタルベルト7の温度は常温から約150℃なので、この範囲での平均線膨張係数は、Fe-35%Niで $2.7 \times 10^{-6}$ /℃、Fe-40%Niで $3.7 \times 10^{-6}$ /℃、Fe-45%Niで $7 \times 10^{-6}$ /℃であり、これらは純Niの $13.5 \times 10^{-6}$ /℃に比べ1/2~1/5という小ささである。これ以外の組成では線膨張係数が大きくなり、純Niと大差なくなつてしまうので合金を利用する意味がなくなつてしまう。

【0018】 さて、このような小さな線膨張係数の電鍍薄膜をステンレス製母型から離型させるには、通常用いられている加熱、冷却による剥離/引き抜きを適用することができない。と言うのは、通常よく用いられている母型材のSUS304とか他の金属材料にしても、ほとんど全ての線膨張係数は上記Fe-Ni合金よりも大きく、加熱、冷却を繰り返しても電鍍薄膜を母型から剥離させることが不可能である。

【0019】 そこで採用したのが電磁誘導加熱による電鍍薄膜のみの急速加熱の方法である。

【0020】 図3は第1の実施例に係るエンドレスメタルベルトの離型装置の構成図である。

5

【0021】円筒型電鍍母型(電極)13の下端は電鍍浴におかされず、離型性のよい絶縁物、例えばPTFEで封止してある(絶縁蓋14)。また、母型13の上部も同じPTFEで厚く被覆されている(絶縁シールド15)。

【0022】このような構成の電鍍母型13を電鍍浴に入れて電鍍を行うと、Fe-Ni電鍍薄膜(エンドレスメタルベルト素材)16が母型電極上のみに形成される。これを水洗、乾燥した後、電磁誘導コイル17の中央部に挿入し、高周波電源18によつてこの電磁誘導コイル17に高周波電流を流す。エンドレスメタルベルトとして用いるFe-Ni電鍍薄膜16の膜厚は約20μmなので、高周波電源として100KHz、200Wのものをを用いると、0.3~0.5秒で電鍍薄膜16は400~500℃まで加熱され、ほとんど瞬間的に母型13から剥離させることができる。

【0023】この時、表皮効果によつて高周波加熱されるのは電鍍薄膜16のみであり、母型13には高周波磁場が進入できないので加熱されず、電鍍薄膜16からの熱伝導による昇温前に剥離が完了する。そして電鍍薄膜16に流れる渦電流と高周波電流の流れる電磁誘導コイル17との間には反発力が働き、電鍍薄膜16がコイル17の中央よりも少し下方に位置している場合は電鍍薄膜16は下方に押し出される力を受ける。即ち、この電磁誘導加熱方式は剥離と同時に引き抜き離型作業を自動的に行う優れた方法なのである。この方法に加えて母型を内部から例えば-50℃程度に冷却して誘導加熱するのも有効である。と言うのは、電鍍浴は通常50℃程度に加熱して電鍍し、母型13によく利用されるSUS304のこの温度域の線膨張係数は $13 \times 10^{-6}$  /℃と大きいので、この低温側への温度差は剥離に或る程度寄与できる母型13の収縮量となるからである。

【0024】このようにして作製したエンドレスメタルベルトにPTFE層を5μmの厚さで被覆して定着用ベルトとした。この非粘着性被膜としては、トナーとの接着力が小さく、非オフセット性に優れたシリコン膜についても試作評価したが、磨耗寿命の点で若干劣る以外はPTFE膜よりも優れた特性を示した。勿論、実用寿命は十分満足できる値である。

【0025】上述の定着用ベルトはエンドレスメタルベルトを母型から離型した後に非粘着層を被覆する方法で作製した。この工程を以下のように簡略することも可能である。それは母型上のエンドレスメタルベルトに非粘着層を被覆し、これを電磁誘導加熱法で剥離して離型する方法である。この場合、非粘着膜は図3の絶縁蓋14、絶縁シールド15の部分にも付着する場合があるが、この部分での接着力はほとんどなく、容易に離型させることが可能である。なお、この絶縁蓋14、絶縁シールド15の部分は離型しやすいように、下方に向かって細くなるようテーパを付けてあることは言うまでもな

6

い。この一括製造法は、ベルトのハンドリングの容易さとか工程の短縮と言う点で前者の製造法より優れている。

【0026】このようにして作製した非粘着膜付きエンドレスメタルベルト7を図1に示すように組み立て、弱いテンションを従動ローラ9によつて付加しながら駆動ローラ8でエンドレスメタルベルト7を回転させ、PTCヒータ素子2に通電電極3を通して交流電圧100Vを印加すると、約10秒後から熱定着動作を行わせることが可能となる。

【0027】この場合、従来法(特願平03-279634号、特願平04-145868号、「熱定着装置」)に比べて冷却距離を短くすることができ、固定発熱体を中凸型状に湾曲させることも不要となつた。このことは冷却支持材6を引き抜きA1材などで作製することが可能となり、部品点数の削減にも貢献した。勿論、「しわ」の発生は完全に防止することが可能となり、寿命的にも何ら問題となる点はなかつた。但し、熱定着装置を通過した記録紙からはそれに吸蔵されていた水分が放出されるので、この付近は換気されるとは言え温度の比較的高い環境である。

【0028】一方、本発明のFe-Ni合金は純Niのベルトでは問題のなかつた腐食が発生しやすい材質である。動作時には常に加熱されるために腐食の出にくい条件にあるとは言え、完全を期するためにはこの対策も必要である。これに対しては以下の方法を採用してこの問題を解決した。それは、電鍍母型13上にもまずNi電鍍を数μm行い、引き続きFe-Ni合金電鍍を行つて合計膜厚を約20μmとし、非粘着膜の被覆以降は前述の通り行つてベルト7を作製するのである。

【0029】このようにNiとFe-Niの連続電鍍を行つても、電鍍浴は同じ系統の電鍍浴を使うので浴塑性に変動がなく、実質的には種類の電鍍を行うのとコスト的に同等である。

【0030】このNi電鍍の膜厚は本熱定着装置の製品寿命とも関係するが、摺動磨耗に耐える膜厚、1~5μmの範囲で選択すればよい。小型レーザビームプリンタ用定着装置としては例えば、10万ページを寿命とすると、このNi厚さは約3μmで十分であつた。即ち、Fe-Ni合金ベルトの両面を腐食から守る被膜でカバーし、ベルトの線膨張係数は厚い芯材のFe-Ni合金で支配させようというのである。寿命評価で何ら問題がなかつたことは言うまでもない。

【0031】図4は第2の実施例に係るエンドレスメタルベルトの離型装置の構成図である。

【0032】この実施例では電磁誘導コイル17の出口側(電鍍薄膜16の引き出し側)のピッチが大で、内側のピッチが小となつている。従つて、電鍍薄膜16は下方に押し出される力を受け、容易に母型13から引き抜くことができる。

7

【0033】図5は母型13に支持したまま表面処理（例えば表面に被膜19を形成）を行う例を示したものであり、このようにするとエンドレスメタルベルト7のハンドリング性を向上させることができる。

【0034】図6は第3の実施例に係るエンドレスメタルベルトの離型装置の構成図である。

【0035】この実施例では電磁誘導コイル17の径を、出口側の方が大きくなるように形成している。このようにすると前述と同様に電鍍薄膜16は下方に押し出される力を受ける。

【0036】ここでエンドレスメタルベルト7の用途としては、プリンタの熱定着装置の他、プリンタの感光体ベルト、印刷装置のプリントマスク等が挙げられる。

【0037】ここで合金電鍍浴の組成例を以下に示す。

【0038】

硫酸ニッケル	230g/l
塩化ニッケル	20g/l
硫酸第一鉄	80g/l
ほう酸	30g/l
添加剤（サツカリン）	0.2g/l
PH	2.8~3.0
浴温	55~60℃
電流密度	1A/dm <sup>2</sup>

これによつて35~40%NiのFe-Ni電鍍薄膜を安定して作製することができる。

【0039】次にエンドレスメタルベルト7のしわ発生率について以下のデータを示す。

【0040】摺動均熱板1を平坦とし、メタルベルトの回転方向の最大温度勾配を10℃/mmとした場合、摺動均熱板1の長手方向にできるメタルベルトのしわの発生数はほぼ下表ようになる。このしわの発生数は摺動均熱板1の湾曲の状態とか加圧ローラの加圧力などにも依存するが下表は比較的にしわの発生し易い状況での値である。

【0041】

Ni含有率	しわ発生数（本/cm）
30	0.5
35	0
40	0
45	~0
50	0.2~0.3
100	0.5

【0042】

8

【発明の効果】本発明によれば、エンドレスメタルベルトの材料として線膨張係数の大幅に小さな鉄-ニッケル合金を用いているので、従来のベルト式熱定着装置で発生しやすかつたベルトの「しわ」を完全に防止することができるようになり、定着装置の小型化、簡易化が達成できた。また、エンドレス鉄-ニッケル合金ベルトを電鍍法で作製した場合、従来技術では電鍍母型から離型させることが不可能であつたが、電磁誘導加熱法を適用することによつてこれを可能とすることができた。

10 【図面の簡単な説明】

【図1】本発明の実施例に係る熱定着装置の縦断面図である。

【図2】Fe-Ni合金の線膨張係数特性図である。

【図3】第1の実施例に係るエンドレスメタルベルトの離型装置の構成図である。

【図4】第2の実施例に係るエンドレスメタルベルトの離型装置の構成図である。

【図5】エンドレスメタルベルトの表面処理の仕方を示す構成図である。

20 【図6】第3の実施例に係るエンドレスメタルベルトの離型装置の構成図である。

【符号の説明】

A 一体構造型加熱冷却デバイス

1 摺動均熱板

2 PTCヒータ素子

3 通電電極

4 耐熱性ホルダ

5 断熱板

6 冷却支持材

30 7 エンドレスメタルベルト

8 駆動ローラ

9 従動ローラ

10 加圧ローラ

11 記録紙

12 未定着トナー

13 円筒型電鍍母型

14 絶縁蓋

15 絶縁シールド

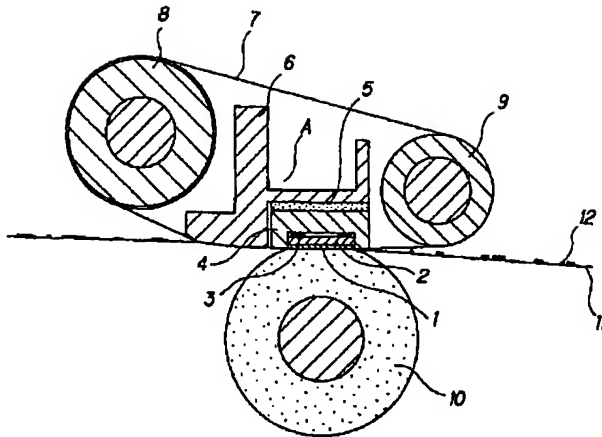
16 電鍍薄膜

40 17 電磁誘導コイル

18 高周波電源

19 被膜

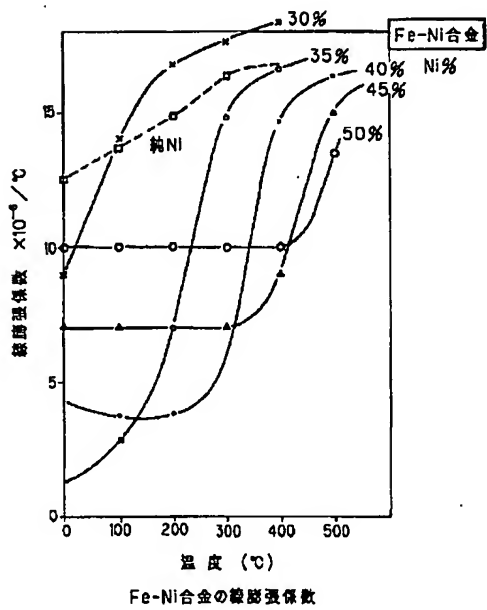
【図1】



【図2】

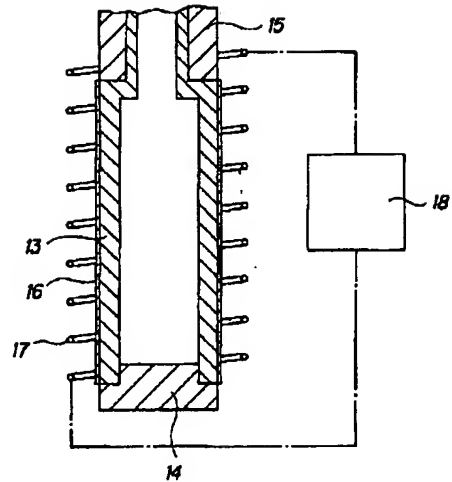
【図2】

【図2】



【図3】

【図3】

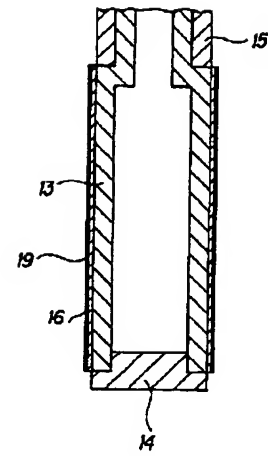
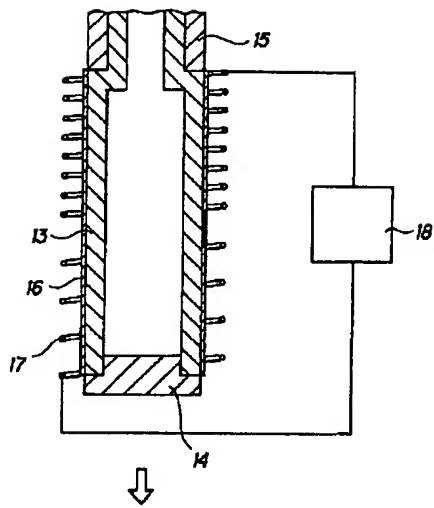


【図4】

【図5】

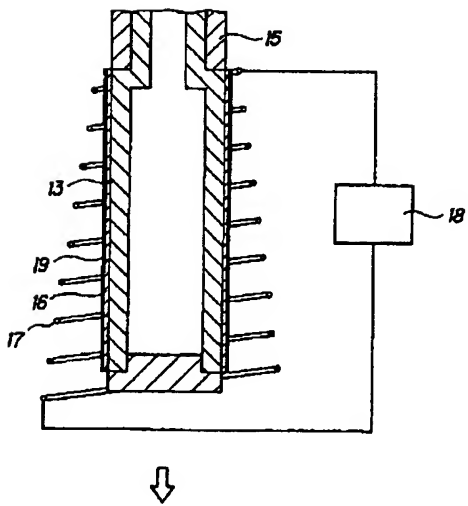
【図4】

【図5】



【図6】

【図6】



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**CLAIMS**

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[Claim(s)]

[Claim 1] While building over the endless metal belt with which non-adhesiveness surface treatment of the outside front face is carried out between a fixed heating element and a rotation driving roller and rotating it in the heat anchorage device which passes the image base material which has a non-established toner image between the pressurization roller which carries out a pressure welding to a fixed heating element, and rotates from the outside of this endless metal belt, and this endless metal belt, and carries out thermofusion fixing of this non-established toner image The heat anchorage device characterized by consisting of an iron nickel alloy with which the outside surface section of said endless metal belt contains 35 - 45% of the weight of nickel.

[Claim 2] The heat anchorage device characterized by the thickness of said outside surface section being thicker than the thickness of said inside surface section by the outside surface section of said endless metal belt consisting of an iron nickel alloy, and the inside surface section of an endless metal belt consisting of nickel in claim 1 publication.

[Claim 3] The heat anchorage device with which total thickness of said endless metal belt is characterized by the thickness of said inside surface section being 1-5 micrometers by 10-50 micrometers in claim 2 publication.

[Claim 4] The manufacturing method of the endless metal belt which carries out rapid heating only of the endless metal belt to the electromagnetic-induction coil which installed said endless metal belt formed in the outside surface of a matrix near [ the ] the periphery, it is therefore made to carry out thermal expansion to it, and is characterized by making an endless metal belt release from mold from this matrix.

[Claim 5] The manufacturing method of the endless metal belt which performs surface preparation predetermined in the condition that this matrix supported the endless metal belt formed in the outside surface of a matrix, and carries out rapid heating only of endless metal \*\* RUTO to the electromagnetic-induction coil installed near the periphery of the account of back to front endless metal belt, it is therefore made to carry out thermal expansion to it, and is characterized by making an endless metal belt release from mold from this matrix.

[Claim 6] The manufacturing method of the endless metal belt characterized by the coefficient of linear expansion of said endless metal belt being below the coefficient of linear expansion of said matrix in claim 4 or five publications.

[Claim 7] The manufacturing method of the endless metal belt characterized by extracting an endless metal belt from a matrix in claim 4 or five publications using the magnetic repulsive force produced between said endless metal belts and electromagnetic-induction coils.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacturing method of the heat anchorage device of image formation equipments, such as electrophotography, and an endless metal belt.

[0002]

[Description of the Prior Art] Although some methods, such as a hot-platen type, a pressure type, and a heating roller type, are put in practical use by the heat fixing assembly indispensable to an electrophotography recording device, the mainstream for [ ten years - ] the past 20 years is a heating roller type. However, this method also has a fault, the time amount to operation initiation is long, power consumption is also large, and the present condition is that these have had bad effect on the engine performance of the whole electrophotography equipment.

[0003] Manufacturing the thin endless film excellent in thermal resistance and rigidity, although the method which improves these radically was proposed for many years (USP No. 3811828 specification) carries out difficulty, and it is \*\*.

[0004] The fixing assembly which combined with JP,1-187582,A the polyimide film by which the coat was carried out with the non-adhesiveness coat, and the heating element is indicated. This heat fixing assembly has succeeded power consumption also in the thing near a reduction by half to do for drastic reduction while it makes that heating up time a short time extremely and realizes the de facto quick start. However, it is short, and the structure of the fixing assembly itself also has the complicated adhesion life of the non-adhesiveness coat which this method also has a fault and is covered by the endless polyimide film, and it is becoming cost quantity.

[0005] this invention persons invented and did patent application of the method which can solve radically the trouble which these fixing assemblies hold, employing efficiently all the descriptions that were excellent in this method (JP,4-166966,A, Japanese Patent Application No. No. 339079 [ two to ], Japanese Patent Application No. No. 49392 [ three to ], Japanese Patent Application No. No. 145868 [ four to ], "heat anchorage device").

[0006] Instead of the endless polyimide film, the endless metal belt was used for the 1st structural description, and it succeeded in therefore prolonging the adhesion life of a non-adhesiveness coat by the satisfactory working life to this. The PTC heater was used for the 2nd description instead of the thick film resistor heater, and, therefore, it made unnecessary the temperature sensor and the power source for temperature control to this. The 3rd description is that dry fixing which therefore does not have offset in it being higher than the glass transition point of a toner, and controlling to a temperature requirement lower than softening temperature has realized temperature which the recording paper after heat fixing releases from mold. Moreover, former is impossible for a flat heat fixing side, record fixing to a \*\*\*\*\* envelope etc. is enabled, and the self-temperature control of a PTC heater is realizing stable heating fixing which does not make mixed continuation fixing of variant paper generate offset, either. Method-simplification brings about the simplification on structure, and reduction of components mark so that the above explanation may show, and they are a thing [ dominance / in cost ], and intermediary \*\*\*\*. The failure which can merely be said to be only on this utilization is generating of the "wrinkling" of an endless metal belt, and is \*\*\*\*\*. Although this adopted nickel belt by electroforming as an endless metal belt obtained most easily,  $14 \times 10^{-6}$  / \*\*, and when it is large and the temperature gradient by local heating is large, this "wrinkling" generates the mean coefficient of linear expansion of nickel belt in a 0-200-degree C temperature requirement. And therefore, this problem was solved to improvement invention (Japanese Patent Application No. No. 145868 [ 04 to ], "heat anchorage device") to

which it is lower than the softening temperature of a toner, however the approach (Japanese Patent Application No. No. 279634 [ 03 to ] "a heat anchorage device") of easing a temperature gradient as a generating preventing method of this "wrinkling" and the temperature which the detail paper after fixing releases from mold from an endless metal belt are brought as much as possible close to this, and a temperature gradient is made small as a result.

[0007]

[Problem(s) to be Solved by the Invention] As mentioned above, in order to be easy to generate the "wrinkling" by local heating in the heat anchorage device using an endless nickel metal belt and to prevent this, it is indispensable to make the temperature gradient of a belt small. For this reason, a cure, like the heating distance and the quenching distance of a belt are needed about 10-20mm, and moreover make a fixed heating element the crown configuration of an inside convex is indispensable, and \*\*\*\*\* these -- the heat anchorage device of this method -- complexity -- it enlarged and an improvement was desired also from the point of a manufacturing cost.

[0008] The 1st purpose of this invention is to control wrinkling generating of an endless metal belt. Moreover, the 2nd purpose is to offer the approach of releasing from mold easily from a matrix in the production process of an endless metal belt. Furthermore, the 3rd purpose is to make easy the handling at the time of endless metal belt side of belt side processing while releasing an endless metal belt from mold easily from a matrix.

[0009]

[Means for Solving the Problem] While the 1st purpose of the above builds over the endless metal belt with which non-adhesiveness surface treatment of the outside front face is carried out between a fixed heating element and a rotation driving roller and rotates it In the heat anchorage device which passes the image base material which has a non-established toner image between the pressurization roller which carries out a pressure welding to a fixed heating element, and rotates from the outside of this endless metal belt, and this endless metal belt, and carries out thermofusion fixing of this non-established toner image The outside surface section of said endless metal belt is attained by the 1st means which consists of an iron nickel alloy containing 35 - 45% of the weight of nickel.

[0010] Moreover, therefore, the 2nd purpose of the above carries out rapid heating only of the endless metal belt to the electromagnetic-induction coil which installed said endless metal belt formed in the outside surface of a matrix near [ the ] the periphery, carries out thermal expansion to it, and is attained by 2nd means to make an endless metal belt release from mold from this matrix.

[0011] Furthermore, the 3rd purpose of the above performs surface preparation predetermined in the condition that this matrix supported the endless metal belt formed in the outside surface of a matrix, therefore, carries out rapid heating only of endless metal \*\* RUTO to the electromagnetic-induction coil installed near the periphery of the account of back to front endless metal belt, carries out thermal expansion to it, and is attained by 3rd means to make an endless metal belt release from mold from this matrix.

[0012]

[Function] As mentioned above, the cause of the "wrinkling" which is easy to generate to an endless nickel metal belt is in the big coefficient of linear expansion. About this, the mean coefficient of linear expansion of a frog and this 0-200-degree C temperature requirement is set to  $1/2 - 1/5$  of nickel metal, and becomes unnecessary [ the generating preventive measures of a "wrinkling" ] also practical at the Fe-nickel alloy of the above presentation range.

[0013]

[Example] The example of this invention is explained with a drawing.

[0014] Drawing 1 is the sectional view of the heat anchorage device of this example.

[0015] The integral-construction mold heating cooling device A with which a heat anchorage device consists of the sliding soak plate 1, the PTC heater component 2, the energization electrode 3, the heat-resistant holder 4, a heat insulator 5, and cooling supporting material 6 Sticking the endless metal belt 7 and the endless metal belt 7 which carried out non-adhering processing of the outside front face to the integral-construction mold heating cooling device A the pressurization roller 10 which carries out follower rotation while being pushed against the driving roller 8 which carries out a rotation drive, the follower roller 9, and the sliding soak plate 1 of the integral-construction mold heating cooling device A by the several kg force -- intermediary \*\*\*\* [ from ].

[0016] As shown in drawing 1, while the detail paper 11 is \*\*\*\*(ed) between the endless metal belt 7 and the pressurization roller 10 The non-established toner 12 on the detail paper 11 carries out heating fusion through

the endless metal belt 7. While a belt 7 is therefore cooled by the cooling supporting material 6, a toner 12 is also cooled, and it is processed so that the detail paper 11 may exfoliate from a belt 7 and the point of the cooling supporting material 6 may become small curvature from an intermediary with toner temperature lower than the softening temperature.

[0017] Therefore, the endless metal belt 7 formed the Fe-nickel alloy thin film (about 20-micrometer thickness) on the circle type matrix made from stainless steel at electroforming, exfoliated and drew this out from the matrix, covered PTFE (polytetrafluoroethylene) with the thickness of 5 micrometers on this outside front face, and produced it on it. nickel presentation in this case was made into 35% - 45% of range (the remainder is Fe). Although the coefficient of linear expansion of a Fe-nickel alloy is shown in drawing 2 Since the temperature of the endless metal belt 7 when being used as a fixing assembly of this invention is about 150 degrees C, from ordinary temperature the mean coefficient of linear expansion in this range It is  $7 \times 10^{-6} / ^\circ\text{C}$  with  $3.7 \times 10^{-6} / ^\circ\text{C}$ , and Fe-45%nickel in  $2.7 \times 10^{-6} / ^\circ\text{C}$ , and Fe-40%nickel with Fe-35%nickel, and these are smallness called  $1/2 - 1/5$  compared with  $13.5 \times 10^{-6} / ^\circ\text{C}$  of pure nickel. Intermediary \*\*\*\*\* which coefficient of linear expansion becomes large in the presentation of those other than this, and does not have the semantics which uses an alloy by that of pure nickel and intermediary \*\*\*\*\* practically equal.

[0018] Now, in order to make the electrocasting thin film of such a small coefficient of linear expansion release from mold from the matrix made from stainless steel, the exfoliation/drawing by heating and cooling which are usually used are inapplicable. Even if it uses to say as SUS304 and other metallic materials of matrix material which are usually used well, almost all coefficient of linear expansion is larger than the above-mentioned Fe-nickel alloy, and even if it repeats heating and cooling, it is impossible to make a electrocasting thin film exfoliate from a matrix.

[0019] Then, what was adopted is the approach of the rapid heating of only the electrocasting thin film by electromagnetic-induction heating.

[0020] Drawing 3 is the block diagram of the mold release equipment of the endless metal belt concerning the 1st example.

[0021] The lower limit of the cylindrical electrocasting matrix (electrode) 13 is not committed by the electrocasting bath, but is closed with the good insulating material of a mold-release characteristic, for example, PTFE, (insulating lid 14). Moreover, the upper part section of a matrix 13 is also thickly covered with the same PTFE (insulating shielding 15).

[0022] If the electrocasting matrix 13 of such a configuration is put into a electrocasting bath and electrocasting is performed, the Fe-nickel electrocasting thin film (endless metal belt material) 16 will be formed only on a matrix electrode. After rinsing this and drying, it inserts in the center section of the electromagnetic-induction coil 17, and, therefore, the high frequency current is passed to RF generator 18 at this electromagnetic-induction coil 17. If the thing of 100kHz and 200W is used as an RF generator, the electrocasting thin film 16 is heated to 400-500 degrees C in 0.3 - 0.5 seconds, and it can be made to exfoliate from a matrix 13 almost momentarily, since the thickness of the Fe-nickel electrocasting thin film 16 used as an endless metal belt is about 20 micrometers.

[0023] At this time, therefore, high-frequency heating is carried out only the electrocasting thin film 16 to the skin effect, since a RF magnetic field cannot advance into a matrix 13, it is not heated, but exfoliation is completed before the temperature up by heat conduction from the electrocasting thin film 16. And repulsive force works between the electromagnetic-induction coils 17 with which the eddy current which flows to the electrocasting thin film 16, and the high frequency current flow, and when the electrocasting thin film 16 is caudad located for a while rather than the center of a coil 17, the electrocasting thin film 16 receives the force extruded caudad. That is, this electromagnetic-induction heating method is the outstanding approach of doing automatically exfoliation and the mold release activity drawn out to coincidence. It is also effective to cool and carry out induction heating of the matrix to about -50 degrees C from the interior in addition to this approach. It is because the coefficient of linear expansion of this temperature region of SUS304 which saying usually heats and electroforms a electrocasting bath at about 50 degrees C, and is well used for a matrix 13 is as large as  $13 \times 10^{-6} / ^\circ\text{C}$ , so the temperature gradient by the side of this low temperature becomes exfoliation with the amount of contraction of a certain matrix 13 which can carry out extent contribution.

[0024] Thus, the PTFE layer was covered with the thickness of 5 micrometers to the produced endless metal belt, and it considered as the belt for fixing. As this non-adhesiveness coat, adhesive strength with a toner was small, and although prototype evaluation was carried out also about the silicone film excellent in un-offsetting

nature, the property superior to the PTFE film was shown except being inferior a little in respect of a wear life. Of course, a working life is a satisfying enough value.

[0025] After the above-mentioned belt for fixing released the endless metal belt from mold from the matrix, it was produced by the approach of covering a non-adhesive layer. It is also possible to carry out simple [ of this process ] as follows. It is the approach of covering a non-adhesive layer to the endless metal belt on a matrix, and exfoliating and releasing this from mold by the electromagnetic-induction heating method. In this case, although the non-adhering film may adhere also to the insulating lid 14 of drawing 3 , and the part of the insulating shielding 15, it is possible for there to be almost no adhesive strength in this part, and to make it release from mold easily. in addition, it is easy to release the parts of this insulating lid 14 and the insulating shielding 15 from mold -- as -- caudad -- Mukai -- it cannot be overemphasized that the taper is attached so that it may become thin once. This package manufacturing method excels the former manufacturing method in the point called the ease of handling of a belt, and compaction of a process.

[0026] Thus, if the endless metal belt 7 is rotated with a driving roller 8 and alternating-voltage 100V are impressed to the PTC heater component 2 through the energization electrode 3, adding [ as shown in drawing 1 , assemble the produced endless metal belt 7 with the non-adhering film, and ] a weak tension to the follower roller 9 therefore, it will become possible after about 10 seconds to make heat fixing actuation perform.

[0027] In this case, it is also needlessness and \*\*\*\*\* to be able to shorten a quenching distance compared with a conventional method (Japanese Patent Application No. No. 279634 [ 03 to ], Japanese Patent Application No. No. 145868 [ 04 to ], "heat anchorage device"), and to incurvate a fixed heating element in the shape of an inside convex type. This became possible [ drawing out the cooling supporting material 6 and producing by aluminum material etc. ], and contributed also to reduction of components mark. Of course, the point which generating of a "wrinkling" becomes possible [ preventing completely ] and poses a problem in any way also in life is inside \*\*\*\*. However, since the moisture by which occlusion was carried out to it from the recording paper which passed the heat anchorage device is emitted, although this neighborhood is ventilated, it is a comparatively humid environment.

[0028] On the other hand, the Fe-nickel alloy of this invention is the quality of the material which the inside \*\*\*\* corrosion in question tends to generate by the belt of pure nickel. Since it is always heated at the time of actuation, although it is in the conditions out of which corrosion cannot come easily, this cure is also required for a term \*\* sake in completeness. The following approaches were adopted to this and this problem was solved. It performs several micrometers nickel electrocasting first on the electrocasting matrix 13, and sets line intermediary sum total thickness to about 20 micrometers for Fe-nickel alloy electrocasting succeedingly, and the line intermediary belt 7 is produced as above-mentioned after covering of the non-adhering film.

[0029] Thus, it is equivalent in [ as there being no fluctuation in bath plasticity about continuation electrocasting of nickel and Fe-nickel since the electrocasting bath of the network same / a electrocasting bath / as a line intermediary can be used, and performing one kind of electrocasting substantially ] cost.

[0030] What is necessary is just to choose the thickness which is equal to sliding wear, and in 1-5 micrometers, although the thickness of this nickel electrocasting is related also to the life cycle of a \*\*\*\* anchorage device. When 100,000 pages is made into a life as an anchorage device for small laser beam printers, about 3 micrometers is enough and this nickel thickness is \*\*\*\*\*. That is, it covers with the coat which protects both sides of a Fe-nickel alloy belt from corrosion, and it is said that it will make the coefficient of linear expansion of a belt govern with the Fe-nickel alloy of a thick core material. life evaluation -- in any way -- a problem -- inside \*\*\*\* -- things cannot be overemphasized.

[0031] Drawing 4 is the block diagram of the mold release equipment of the endless metal belt concerning the 2nd example.

[0032] For the pitch of the outlet side (drawer side of the electrocasting thin film 16) of the electromagnetic-induction coil 17, at this example, an inside pitch is smallness and intermediary \*\*\*\* in size. Therefore, the electrocasting thin film 16 can receive the force extruded caudad, and can draw it out from a matrix 13 easily.

[0033] If drawing 5 shows the example which performs surface treatment (a coat 19 is formed in a front face), supporting to a matrix 13 and carries out it in this way, it can raise the handling nature of the endless metal belt 7.

[0034] Drawing 6 is the block diagram of the mold release equipment of the endless metal belt concerning the 3rd example.

[0035] In this example, the path of the electromagnetic-induction coil 17 is formed so that the direction of an

outlet side may become large. If it does in this way, the electrocasting thin film 16 will receive the force extruded caudad like the above-mentioned.

[0036] As an application of the endless metal belt 7, the photo conductor belt of a printer besides the heat anchorage device of a printer, the print mask of an airline printer, etc. are mentioned here.

[0037] The example of a presentation of an alloy electrocasting bath is shown below here.

[0038]

A nickel sulfate A 230 g/l nickel chloride 20 g/l ferrous sulfate 80 g/l way acid 30 g/l additive (saccharin) 0.2 g/lPH 2.8 to 3.0 bath temperature 55-60-degree-C current density 1 A/dm<sup>2</sup> -- therefore, the Fe-nickel electrocasting thin film of 35 - 40%nickel can be stabilized and produced to this.

[0039] Next, the following data are shown about the wrinkling incidence rate of the endless metal belt 7.

[0040] When the sliding soak plate 1 is made flat and the maximum temperature gradient of the hand of cut of a metal belt is carried out in 10 degrees C/mm, the occurrences of the wrinkling of the metal belt made into the longitudinal direction of the sliding soak plate 1 become almost as it is shown in the following table. Although the occurrences of this wrinkling are dependent on the condition of a curve of the sliding soak plate 1, the welding pressure of a pressurization roller, etc., the following table is a value in the situation which a wrinkling tends to generate in comparison.

[0041]

nickel content Wrinkling occurrences (cm/)

30 0.535 040 045 - 050 0.2-0.3100 0.5 [0042]

[Effect of the Invention] According to this invention, since the iron nickel alloy with a coefficient of linear expansion sharply small as an ingredient of an endless metal belt was used, it could generate with the conventional belt type heat anchorage device, the "wrinkling" of \*\*\*\* and a \*\* belt can be completely prevented now, and the miniaturization of an anchorage device and simplification have been attained.

Moreover, when an endless iron nickel alloy belt was produced with electroforming, with the conventional technique, it was impossible to have made it release from mold from a electrocasting matrix, and, therefore, \*\*\*\*\* was able to make this possible applying the electromagnetic-induction heating method.

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TECHNICAL FIELD

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[Industrial Application] This invention relates to the manufacturing method of the heat anchorage device of image formation equipments, such as electrophotography, and an endless metal belt.

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PRIOR ART

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[Description of the Prior Art] Although some methods, such as a hot-platen type, a pressure type, and a heating roller type, are put in practical use by the heat fixing assembly indispensable to an electrophotography recording device, the mainstream for [ ten years - ] the past 20 years is a heating roller type. However, this method also has a fault, the time amount to operation initiation is long, power consumption is also large, and the present condition is that these have had bad effect on the engine performance of the whole electrophotography equipment.

[0003] Manufacturing the thin endless film excellent in thermal resistance and rigidity, although the method which improves these radically was proposed for many years (USP No. 3811828 specification) carries out difficulty, and it is \*\*.

[0004] The fixing assembly which combined with JP,1-187582,A the polyimide film by which the coat was carried out with the non-adhesiveness coat, and the heating element is indicated. This heat fixing assembly has succeeded power consumption also in the thing near a reduction by half to do for drastic reduction while it makes that heating up time a short time extremely and realizes the de facto quick start. However, it is short, and the structure of the fixing assembly itself also has the complicated adhesion life of the non-adhesiveness coat which this method also has a fault and is covered by the endless polyimide film, and it is becoming cost quantity.

[0005] this invention persons invented and did patent application of the method which can solve radically the trouble which these fixing assemblies hold, employing efficiently all the descriptions that were excellent in this method (JP,4-166966,A, Japanese Patent Application No. No. 339079 [ two to ], Japanese Patent Application No. No. 49392 [ three to ], Japanese Patent Application No. No. 145868 [ four to ], "heat anchorage device").

[0006] Instead of the endless polyimide film, the endless metal belt was used for the 1st structural description, and it succeeded in therefore prolonging the adhesion life of a non-adhesiveness coat by the satisfactory working life to this. The PTC heater was used for the 2nd description instead of the thick film resistor heater, and, therefore, it made unnecessary the temperature sensor and the power source for temperature control to this. The 3rd description is that dry fixing which therefore does not have offset in it being higher than the glass transition point of a toner, and controlling to a temperature requirement lower than softening temperature has realized temperature which the recording paper after heat fixing releases from mold. Moreover, former is impossible for a flat heat fixing side, record fixing to a \*\*\*\*\* envelope etc. is enabled, and the self-temperature control of a PTC heater is realizing stable heating fixing which does not make mixed continuation fixing of variant paper generate offset, either. Method-simplification brings about the simplification on structure, and reduction of components mark so that the above explanation may show, and they are a thing [ dominance / in cost ], and intermediary \*\*\*\*. The failure which can merely be said to be only on this utilization is generating of the "wrinkling" of an endless metal belt, and is \*\*\*\*\*. Although this adopted nickel belt by electroforming as an endless metal belt obtained most easily,  $14 \times 10^{-6}$  / \*\*, and when it is large and the temperature gradient by local heating is large, this "wrinkling" generates the mean coefficient of linear expansion of nickel belt in a 0-200-degree C temperature requirement. And therefore, this problem was solved to improvement invention (Japanese Patent Application No. No. 145868 [ 04 to ], "heat anchorage device") to which it is lower than the softening temperature of a toner, however the approach (Japanese Patent Application No. No. 279634 [ 03 to ] "a heat anchorage device") of easing a temperature gradient as a generating preventing method of this "wrinkling" and the temperature which the detail paper after fixing releases from mold from an endless metal belt are brought as much as possible close to this, and a temperature gradient is made small as a result.

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EFFECT OF THE INVENTION

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[Effect of the Invention] According to this invention, since the iron nickel alloy with a coefficient of linear expansion sharply small as an ingredient of an endless metal belt was used, it could generate with the conventional belt type heat anchorage device, the "wrinkling" of \*\*\*\* and a \*\* belt can be completely prevented now, and the miniaturization of an anchorage device and simplification have been attained. Moreover, when an endless iron nickel alloy belt was produced with electroforming, with the conventional technique, it was impossible to have made it release from mold from a electrocasting matrix, and, therefore, \*\*\*\*\* was able to make this possible applying the electromagnetic-induction heating method.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] As mentioned above, in order to be easy to generate the "wrinkling" by local heating in the heat anchorage device using an endless nickel metal belt and to prevent this, it is indispensable to make the temperature gradient of a belt small. For this reason, a cure, like the heating distance and the quenching distance of a belt are needed about 10-20mm, and moreover make a fixed heating element the crown configuration of an inside convex is indispensable, and \*\*\*\*\* these -- the heat anchorage device of this method -- complexity -- it enlarged and an improvement was desired also from the point of a manufacturing cost.

[0008] The 1st purpose of this invention is to control wrinkling generating of an endless metal belt. Moreover, the 2nd purpose is to offer the approach of releasing from mold easily from a matrix in the production process of an endless metal belt. Furthermore, the 3rd purpose is to make easy the handling at the time of endless metal hair side of belt side processing while releasing an endless metal belt from mold easily from a matrix.

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MEANS

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[Means for Solving the Problem] While the 1st purpose of the above builds over the endless metal belt with which non-adhesiveness surface treatment of the outside front face is carried out between a fixed heating element and a rotation driving roller and rotates it In the heat anchorage device which passes the image base material which has a non-established toner image between the pressurization roller which carries out a pressure welding to a fixed heating element, and rotates from the outside of this endless metal belt, and this endless metal belt, and carries out thermofusion fixing of this non-established toner image The outside surface section of said endless metal belt is attained by the 1st means which consists of an iron nickel alloy containing 35 - 45% of the weight of nickel.

[0010] Moreover, therefore, the 2nd purpose of the above carries out rapid heating only of the endless metal belt to the electromagnetic-induction coil which installed said endless metal belt formed in the outside surface of a matrix near [ the ] the periphery, carries out thermal expansion to it, and is attained by 2nd means to make an endless metal belt release from mold from this matrix.

[0011] Furthermore, the 3rd purpose of the above performs surface preparation predetermined in the condition that this matrix supported the endless metal belt formed in the outside surface of a matrix, therefore, carries out rapid heating only of endless metal \*\* RUTO to the electromagnetic-induction coil installed near the periphery of the account of back to front endless metal belt, carries out thermal expansion to it, and is attained by 3rd means to make an endless metal belt release from mold from this matrix.

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OPERATION

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[Function] As mentioned above, the cause of the "wrinkling" which is easy to generate to an endless nickel metal belt is in the big coefficient of linear expansion. About this, the mean coefficient of linear expansion of a frog and this 0-200-degree C temperature requirement is set to  $1/2 - 1/5$  of nickel metal, and becomes unnecessary [ the generating preventive measures of a "wrinkling" ] also practical at the Fe-nickel alloy of the above presentation range.

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EXAMPLE

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[Example] The example of this invention is explained with a drawing.

[0014] Drawing 1 is the sectional view of the heat anchorage device of this example.

[0015] The integral-construction mold heating cooling device A with which a heat anchorage device consists of the sliding soak plate 1, the PTC heater component 2, the energization electrode 3, the heat-resistant holder 4, a heat insulator 5, and cooling supporting material 6. Sticking the endless metal belt 7 and the endless metal belt 7 which carried out non-adhering processing of the outside front face to the integral-construction mold heating cooling device A the pressurization roller 10 which carries out follower rotation while being pushed against the driving roller 8 which carries out a rotation drive, the follower roller 9, and the sliding soak plate 1 of the integral-construction mold heating cooling device A by the several kg force -- intermediary \*\*\*\* [ from ].

[0016] As shown in drawing 1, while the detail paper 11 is \*\*\*\*(ed) between the endless metal belt 7 and the pressurization roller 10. The non-established toner 12 on the detail paper 11 carries out heating fusion through the endless metal belt 7. While a belt 7 is therefore cooled by the cooling supporting material 6, a toner 12 is also cooled, and it is processed so that the detail paper 11 may exfoliate from a belt 7 and the point of the cooling supporting material 6 may become small curvature from an intermediary with toner temperature lower than the softening temperature.

[0017] Therefore, the endless metal belt 7 formed the Fe-nickel alloy thin film (about 20-micrometer thickness) on the circle type matrix made from stainless steel at electroforming, exfoliated and drew this out from the matrix, covered PTFE (polytetrafluoroethylene) with the thickness of 5 micrometers on this outside front face, and produced it on it. nickel presentation in this case was made into 35% - 45% of range (the remainder is Fe). Although the coefficient of linear expansion of a Fe-nickel alloy is shown in drawing 2. Since the temperature of the endless metal belt 7 when being used as a fixing assembly of this invention is about 150 degrees C, from ordinary temperature the mean coefficient of linear expansion in this range It is  $7 \times 10^{-6} / ^\circ\text{C}$  with  $3.7 \times 10^{-6} / ^\circ\text{C}$ , and Fe-45%nickel in  $2.7 \times 10^{-6} / ^\circ\text{C}$ , and Fe-40%nickel with Fe-35%nickel, and these are smallness called 1 / 2 - 1/5 compared with  $13.5 \times 10^{-6} / ^\circ\text{C}$  of pure nickel. Intermediary \*\*\*\*\* which coefficient of linear expansion becomes large in the presentation of those other than this, and does not have the semantics which uses an alloy by that of pure nickel and intermediary \*\*\*\*\* practically equal.

[0018] Now, in order to make the electrocasting thin film of such a small coefficient of linear expansion release from mold from the matrix made from stainless steel, the exfoliation/drawing by heating and cooling which are usually used are inapplicable. Even if it uses to say as SUS304 and other metallic materials of matrix material which are usually used well, almost all coefficient of linear expansion is larger than the above-mentioned Fe-nickel alloy, and even if it repeats heating and cooling, it is impossible to make a electrocasting thin film exfoliate from a matrix.

[0019] Then, what was adopted is the approach of the rapid heating of only the electrocasting thin film by electromagnetic-induction heating.

[0020] Drawing 3 is the block diagram of the mold release equipment of the endless metal belt concerning the 1st example.

[0021] The lower limit of the cylindrical electrocasting matrix (electrode) 13 is not committed by the electrocasting bath, but is closed with the good insulating material of a mold-release characteristic, for example, PTFE, (insulating lid 14). Moreover, the upper part section of a matrix 13 is also thickly covered with the same PTFE (insulating shielding 15).

[0022] If the electrocasting matrix 13 of such a configuration is put into a electrocasting bath and electrocasting is performed, the Fe-nickel electrocasting thin film (endless metal belt material) 16 will be formed only on a

matrix electrode. After rinsing this and drying, it inserts in the center section of the electromagnetic-induction coil 17, and, therefore, the high frequency current is passed to RF generator 18 at this electromagnetic-induction coil 17. If the thing of 100kHz and 200W is used as an RF generator, the electrocasting thin film 16 is heated to 400-500 degrees C in 0.3 - 0.5 seconds, and it can be made to exfoliate from a matrix 13 almost momentarily, since the thickness of the Fe-nickel electrocasting thin film 16 used as an endless metal belt is about 20 micrometers.

[0023] At this time, therefore, high-frequency heating is carried out only the electrocasting thin film 16 to the skin effect, since a RF magnetic field cannot advance into a matrix 13, it is not heated, but exfoliation is completed before the temperature up by heat conduction from the electrocasting thin film 16. And repulsive force works between the electromagnetic-induction coils 17 with which the eddy current which flows to the electrocasting thin film 16, and the high frequency current flow, and when the electrocasting thin film 16 is caudad located for a while rather than the center of a coil 17, the electrocasting thin film 16 receives the force extruded caudad. That is, this electromagnetic-induction heating method is the outstanding approach of doing automatically exfoliation and the mold release activity drawn out to coincidence. It is also effective to cool and carry out induction heating of the matrix to about -50 degrees C from the interior in addition to this approach. It is because the coefficient of linear expansion of this temperature region of SUS304 which saying usually heats and electroforms a electrocasting bath at about 50 degrees C, and is well used for a matrix 13 is as large as  $13 \times 10^{-6} / ^\circ\text{C}$ , so the temperature gradient by the side of this low temperature becomes exfoliation with the amount of contraction of a certain matrix 13 which can carry out extent contribution.

[0024] Thus, the PTFE layer was covered with the thickness of 5 micrometers to the produced endless metal belt, and it considered as the belt for fixing. As this non-adhesiveness coat, adhesive strength with a toner was small, and although prototype evaluation was carried out also about the silicone film excellent in un-offsetting nature, the property superior to the PTFE film was shown except being inferior a little in respect of a wear life. Of course, a working life is a satisfying enough value.

[0025] After the above-mentioned belt for fixing released the endless metal belt from mold from the matrix, it was produced by the approach of covering a non-adhesive layer. It is also possible to carry out simple [ of this process ] as follows. It is the approach of covering a non-adhesive layer to the endless metal belt on a matrix, and exfoliating and releasing this from mold by the electromagnetic-induction heating method. In this case, although the non-adhering film may adhere also to the insulating lid 14 of drawing 3, and the part of the insulating shielding 15, it is possible for there to be almost no adhesive strength in this part, and to make it release from mold easily. in addition, it is easy to release the parts of this insulating lid 14 and the insulating shielding 15 from mold -- as -- caudad -- Mukai -- it cannot be overemphasized that the taper is attached so that it may become thin once. This package manufacturing method excels the former manufacturing method in the point called the ease of handling of a belt, and compaction of a process.

[0026] Thus, if the endless metal belt 7 is rotated with a driving roller 8 and alternating-voltage 100V are impressed to the PTC heater component 2 through the energization electrode 3, adding [ as shown in drawing 1 ], assemble the produced endless metal belt 7 with the non-adhering film, and ] a weak tension to the follower roller 9 therefore, it will become possible after about 10 seconds to make heat fixing actuation perform.

[0027] In this case, it is also needlessness and \*\*\*\*\* to be able to shorten a quenching distance compared with a conventional method (Japanese Patent Application No. No. 279634 [ 03 to ], Japanese Patent Application No. No. 145868 [ 04 to ], "heat anchorage device"), and to incurvate a fixed heating element in the shape of an inside convex type. This became possible [ drawing out the cooling supporting material 6 and producing by aluminum material etc. ], and contributed also to reduction of components mark. Of course, the point which generating of a "wrinkling" becomes possible [ preventing completely ] and poses a problem in any way also in life is inside \*\*\*\*. However, since the moisture by which occlusion was carried out to it from the recording paper which passed the heat anchorage device is emitted, although this neighborhood is ventilated, it is a comparatively humid environment.

[0028] On the other hand, the Fe-nickel alloy of this invention is the quality of the material which the inside \*\*\*\* corrosion in question tends to generate by the belt of pure nickel. Since it is always heated at the time of actuation, although it is in the conditions out of which corrosion cannot come easily, this cure is also required for a term \*\* sake in completeness. The following approaches were adopted to this and this problem was solved. It performs several micrometers nickel electrocasting first on the electrocasting matrix 13, and sets line intermediary sum total thickness to about 20 micrometers for Fe-nickel alloy electrocasting succeedingly, and

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When 100,000 pages is made into a life as an anchorage device for small laser beam printers, about 3 micrometers is enough and this nickel thickness is \*\*\*\*\*. That is, it covers with the coat which protects both sides of a Fe-nickel alloy belt from corrosion, and it is said that it will make the coefficient of linear expansion of a belt govern with the Fe-nickel alloy of a thick core material. life evaluation -- in any way -- a problem -- inside \*\*\*\* -- things cannot be overemphasized.

[0031] Drawing 4 is the block diagram of the mold release equipment of the endless metal belt concerning the 2nd example.

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[0038]  
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[0041]  
nickel content Wrinkling occurrences (cm/  
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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1] It is drawing of longitudinal section of the heat anchorage device concerning the example of this invention.

[Drawing 2] It is the coefficient-of-linear-expansion property Fig. of a Fe-nickel alloy.

[Drawing 3] It is the block diagram of the mold release equipment of the endless metal belt concerning the 1st example.

[Drawing 4] It is the block diagram of the mold release equipment of the endless metal belt concerning the 2nd example.

[Drawing 5] It is the block diagram showing the method of endless metal hair side of belt side processing.

[Drawing 6] It is the block diagram of the mold release equipment of the endless metal belt concerning the 3rd example.

**[Description of Notations]**

A Integral-construction mold heating cooling device

1 Sliding Soak Plate

2 PTC Heater Component

3 Energization Electrode

4 Heat-resistant Holder

5 Heat Insulation Plate

6 Cooling Supporting Material

7 Endless Metal Belt

8 Driving Roller

9 Follower Roller

10 Pressurization Roller

11 Recording Paper

12 Non-Established Toner

13 Cylindrical Electrocasting Matrix

14 Insulating Lid

15 Insulating Shielding

16 Electrocasting Thin Film

17 Electromagnetic-Induction Coil

18 RF Generator

19 Coat

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[Translation done.]

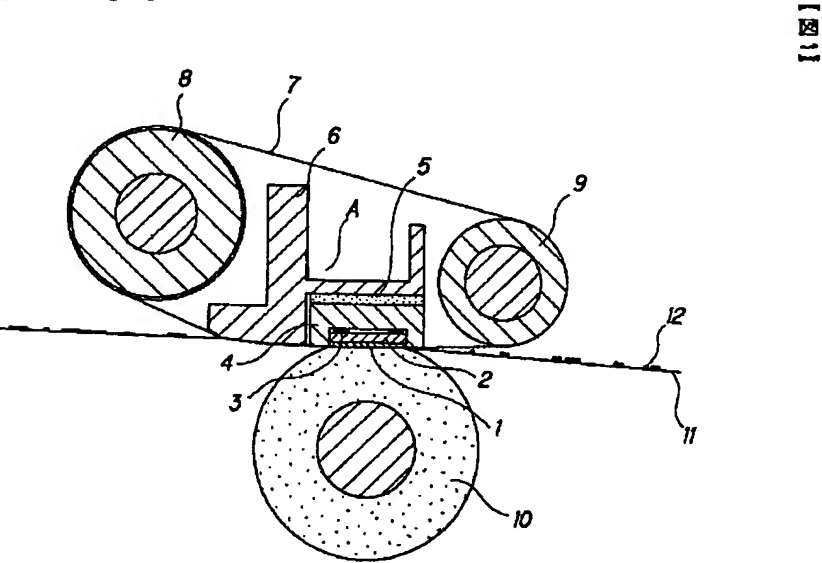
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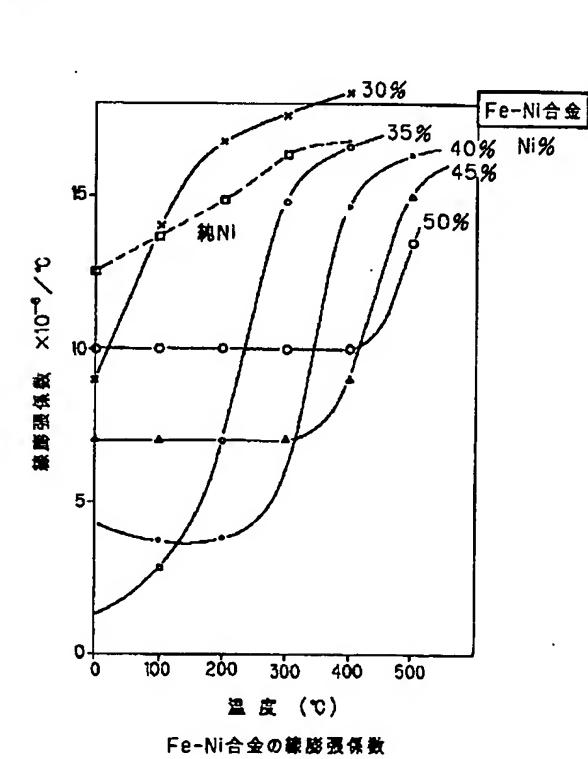
DRAWINGS

[Drawing 1]

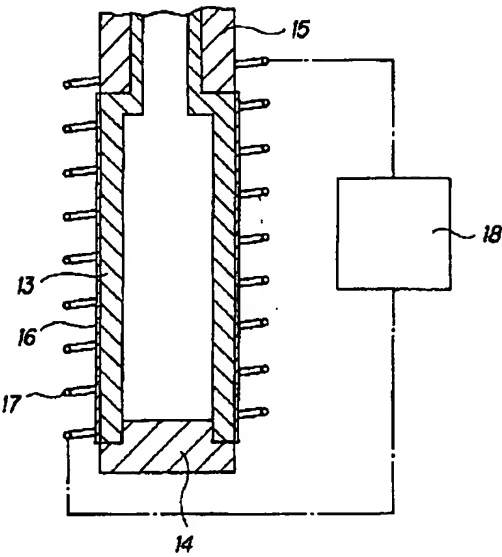


[Drawing 2]

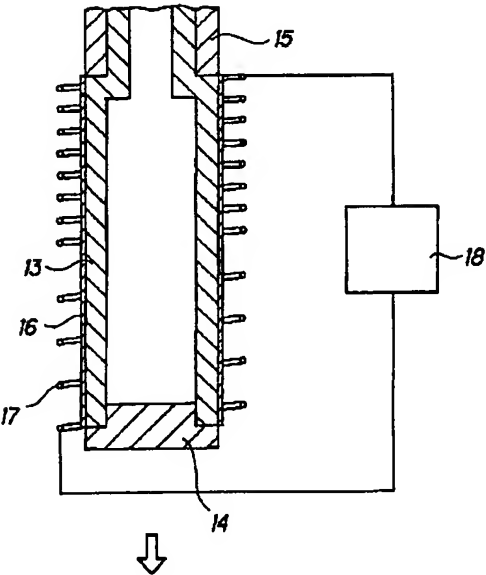
【図2】



[Drawing 3]  
【図 3】

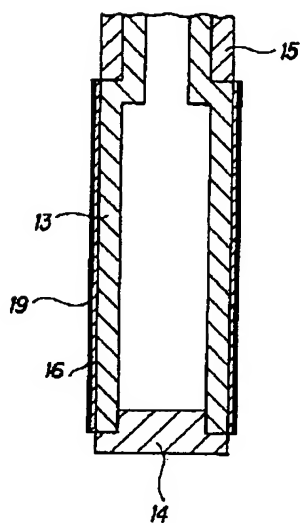
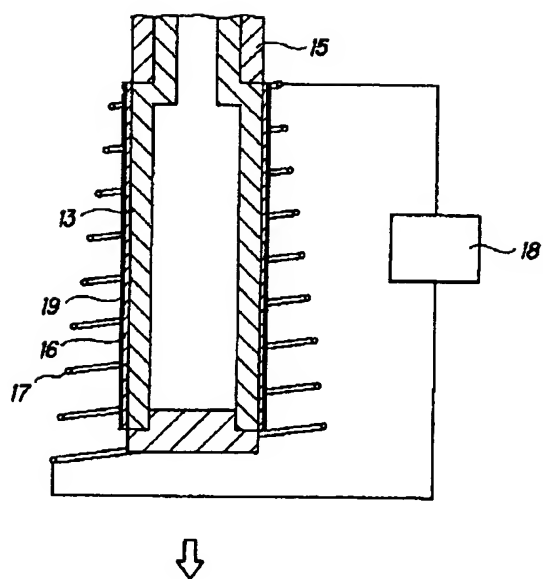


[Drawing 4]  
【図 4】



[Drawing 5]

【図5】

[Drawing 6]  
【図6】

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[Translation done.]